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BREDIN-ARCHBOLD-SMITHSONIAN BIOLOGICAL SURVEY OF DOMINICA

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1. The Echinoids of Dominica [1]

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Although the echinoids have been described from most of the larger islands of the Caribbean, no one has ever reported the echinoids of Dominica. As a member of the Bredin-Archbold-Smithsonian Biological Survey of Dominica, I spent April 1964 studying and collecting echinoids off the island. Underwater diving apparatus was used to make traverses down to 85-foot depths off most of the promotories and in most of the bays. Live individuals were found in 8 of the 10 species collected and their living positions are described. Most of the diving was done in the Caribbean because of the lack of suitable boats on the Atlantic side of the island.

I thank Miss Maureen Downey of the U.S. National Museum for identifying the basket stars and crinoids and Mr. Louis R. Purnell for making the drawings. I wish also to thank William P. Campbell, who assisted in the collecting.

[1] This paper is the first of a series on the faunal studies from the survey that will appear in the "Proceedings of the United States National Museum." A companion series on the flora will appear in the "Contributions of the United States National Museum."

General Description of Coast

The island is of great relief with a high gradient to the shore. Off the promotories the gradient is so steep that in some places there is only a narrow belt less than 100 feet wide with depths of less than 85 feet. The lowest gradients were in some of the sandy bays such as that at Mero, where a depth greater than 85 feet was not encountered within a half mile of the shore. Two main types of environments were apparent on the Caribbean side of the island: the rocky-coral areas and the sand areas.

Rocky-Coral Environment

Off the promontories the bottom is generally rocky with many corals and sponges (fig. 1; pl. 1: fig. 1). Small sandy patches of approximately 100 square feet occur within this rock-coral. Usually this

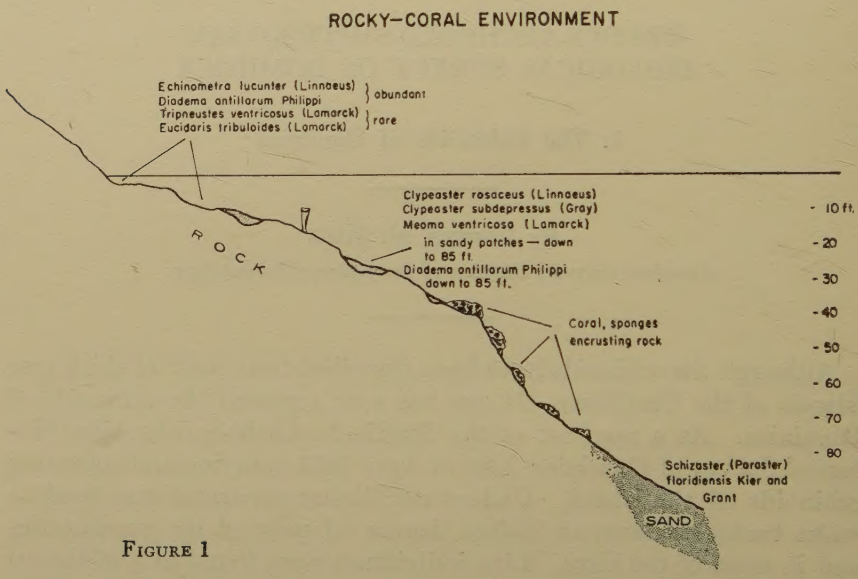

FIGURE 1

rocky-coral area continues down to approximately 75 feet, where the rock ceases, and sand continues downward at a steep grade. Although some of the coral masses are large, most of them are not very thick and barely cover the rocky substrate. The crinoid *Comactinia echinoptera* (Muller) lives commonly in crevices (pl. 1: fig. 1) in the coral from depths of 15–85 feet and probably deeper.

In the shallow water of the rocky-coral areas, from low tide to 10 feet, the most common echinoid is *Diadema antillarum* Philippi (pl. 2: figs. 4, 5) except in areas of strong current, where *Echinometra lucunter* (Linnaeus) is more abundant. I saw a few specimens of *Eucidaris*

tribuloides (Lamarck) and *Tripneustes ventricosus* (Lamarck) (pl. 2: fig. 4).

Below 10 feet, *Diadema antillarum* was the only echinoid seen in any numbers. The spatangoid *Meoma ventricosa* (Lamarck) lives in the sandy patches together with a few individuals of *Clypeaster subdepressus* (Gray) and *C. rosaceus* (Linnaeus).

Sand Environment

The bottom of the bays are mostly sand or silt except for a narrow band of gravel at the shoreline (fig. 2). Only one echinoid, *Leodia sexiesperforata* (Leske), was found in the shallower parts of these sandy areas. Between 25 and 65 feet holothurians were encountered

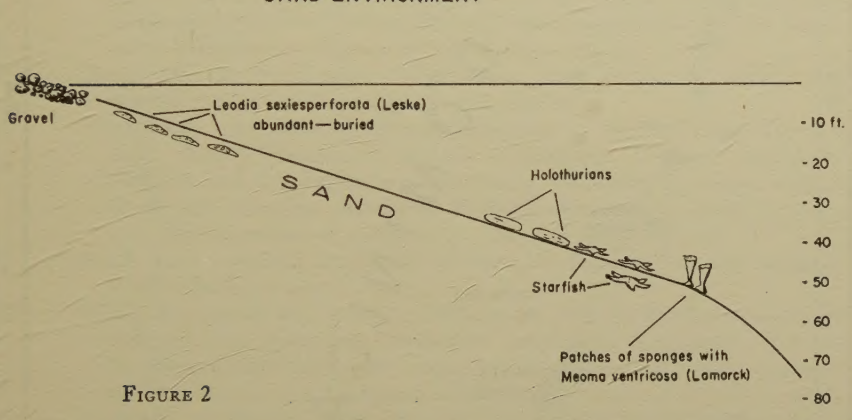

FIGURE 2

frequently and, at one site north of Tarreau Point at 50 feet depth, the starfish *Oreaster reticulatus* (Linneaus) was present in great numbers. In a few of these sandy areas small patches of sponges and a few specimens of *Meoma ventricosa* (Lamarck) were present between the depths of 25 and 50 feet.

Echinoids and Their Localities

species	*locality*
Eucidaris tribuloides (Lamarck)	8
Tripneustes ventricosus (Lamarck)	8, 10, 18
Echinometra lucunter (Linnaeus)	8, 14–16, 18
Echinometra viridis Agassiz	8
Diadema antillarum Philippi	1–3, 5, 6, 8, 10, 13–17
Clypeaster subdepressus (Gray)	2, 6, 10, 13
Clypeaster rosaceus (Linnaeus)	10
Leodia sexiesperforata (Leske)	7, 9, 12
Meoma ventricosa (Lamarck)	2–4, 6, 10, 12
Schizaster (*Paraster*) *floridiensis* Kier and Grant	4

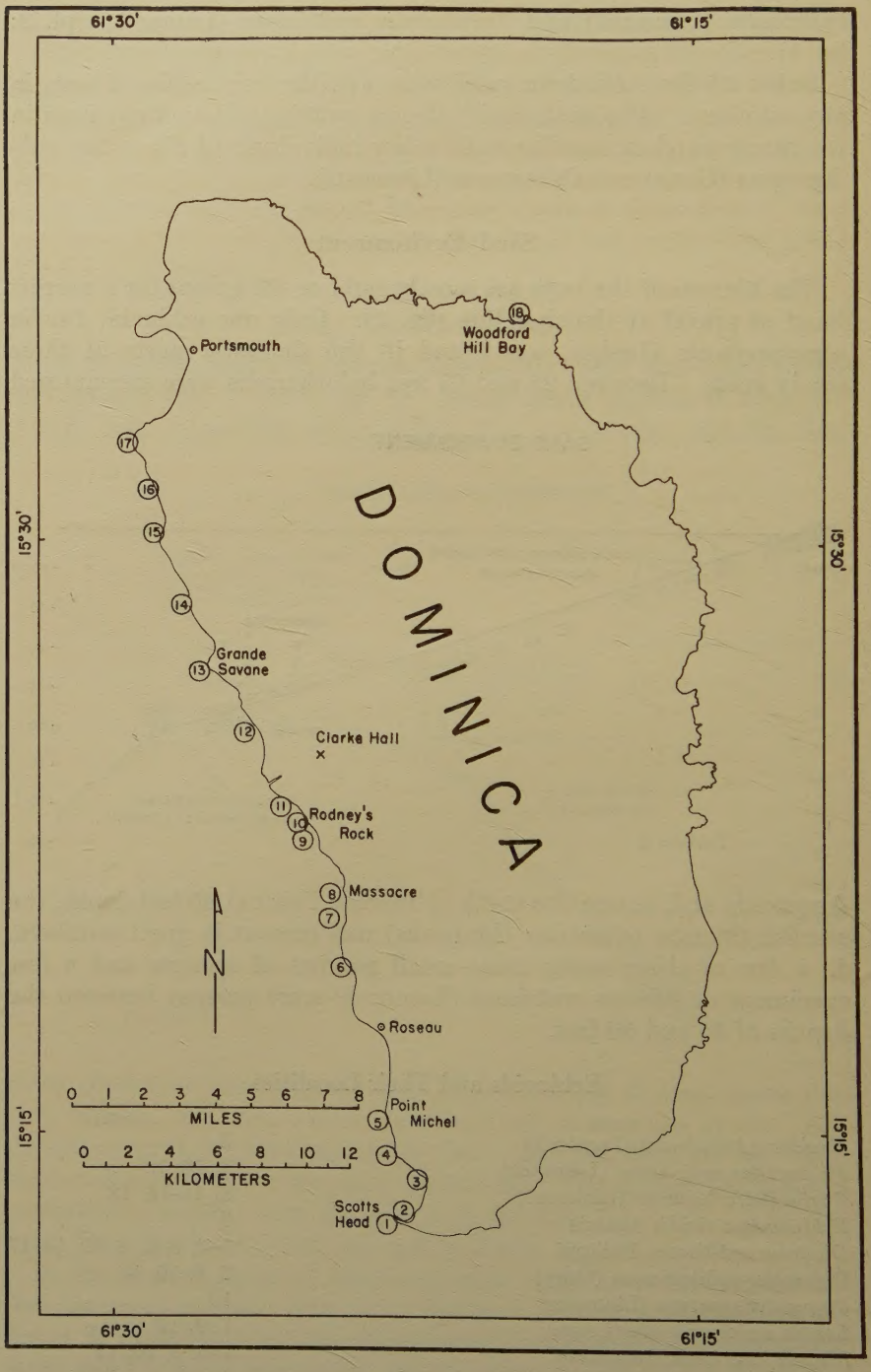
61°30'
61°15'
15°30'
15°15'
DOMINICA
Portsmouth
Woodford Hill Bay
Grande Savane
Clarke Hall
Rodney's Rock
Massacre
Roseau
Point Michel
Scotts Head
N
0 1 2 3 4 5 6 7 8
MILES
0 2 4 6 8 10 12
KILOMETERS

FIGURE 3

Locality Data

numerals=location of stations on map (fig. 3)

1 Rocky, few corals, sponges, many *Diadema antillarum* Philippi.

2 Abundant corals, extensive flat area of *Porpites*, large brain corals, dropping rapidly from depth of 25 feet. Abundant crinoids, many *Diadema antillarum* Philippi, *Meoma ventricosa* (Lamarck), few (4 dead tests) *Clypeaster subdepressus* (Gray).

3 Rocky area with few corals, *Diadema antillarum* Philippi in great numbers, one *Meoma ventricosa* (Lamarck) in sandy patch at 50-foot depth. Two basket stars.

4 Rocky area with few corals down to 60 feet, sand at greater depth. At 65 to 85 feet many *Meoma ventricosa* (Lamarck); one *Schizaster* (*Paraster*) *floridiensis* Kier and Grant at 85 feet.

5 Rocky area with few corals, abundant *Diadema antillarum* Philippi.

6 Rocky area with many corals, large sandy patches in shallower region (10′–20′); large sponges, many crinoids and basket stars, abundant *Diadema antillarum* Philippi, *Meoma ventricosa* (Lamarck), one living, many dead tests of *Clypeaster subdepressus* (Gray).

7 Sandy area, no coral, many holothurians, small amount of grass, many conchs, many *Leodia sexiesperforata* (Leske).

8 Rocky area, many corals, sponges, crinoids, on shallow ledge, 1–2 feet deep, many *Echinometra lucunter* (Linnaeus), *Diadema antillarum* Philippi, and few *Tripneustes ventricosus* (Lamarck) in deeper waters, 10–60 feet, *Diadema antillarum* Philippi, *Echinometra viridis* Agassiz, and *Meoma ventricosa* (Lamarck). No rock below 75 feet.

9 Sandy area, no corals, many holothurians, conchs, small amount of grass, *Leodia sexiesperforata* (Leske).

10 Rocky area first 25 feet with few corals, many crinoids, *Diadema antillarum* Philippi, one specimen *Tripneustes ventricosus* (Lamarck) (2 feet), *Meoma ventricosa* (Lamarck) in sandy patches, few dead test of *Clypeaster rosaceus* (Linnaeus), *Clypeaster subdepressus* (Gray) at 25 feet in sandy patch. At depths greater than 25 feet, no rock, sandy bottom, small amount of grass, one *Tripneustes ventricosus* at 30 feet.

11 Sandy area, small amount of grass, many *Oreaster reticulatus* (Linneaus), two basket stars.

12 Sandy area, *Leodia sexiesperforata* (Leske) in great numbers at 5–20 feet; at 25 feet, rocky ledge with corals, sponges, crinoids, and *Meoma ventricosa* (Lamarck), *Diadema antillarum* Philippi, at 60 feet sand again.

13 Rocky area heavy currents, few corals, sea fans, sea whips, *Diadema antillarum* Philippi, many dead tests of *Clypeaster subdepressus* (Gray).

14–16 *Echinometra lucunter* (Linnaeus), *Diadema antillarum* Philippi in shallow water.

17 Rocky area down to 35 feet with corals, sponges, sea whips, *Diadema antillarum* Philippi. Below 35 feet sandy with conches and holothurians.

18 Rocky area, heavy currents, in shallow water many *Echinometra lucunter* (Linnaeus), in 10–15 feet on rock platform abundant *Tripneustes ventricosus* (Lamarck).

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Discussion of Species

Descriptions, synonyms, and illustrations of the species discussed below can be found in Mortensen (1928–1951), and Kier and Grant (1965).

Eucidaris tribuloides (Lamarck)

Only one specimen of this species was seen on the Caribbean side: in two feet of water in a crevice between a sponge and rock. Living with it were many individuals of *Echinometra lucunter* (Linnaeus) and *Diadema antillarum* Philippi.

Tripneustes ventricosus (Lamarck)

PLATES 1 (FIG. 2), 2 (FIG. 4)

Only three specimens were seen in the Caribbean. Two of them (pl. 2: fig. 4) occurred in just two feet of water on a rock outcrop, one of them up under a rock. The third specimen was in 30 feet of water on sandy, grassy bottom. None of the specimens had any weed or fragments held over its test. Although a thorough search was made for more specimens, none was found.

On the Atlantic side this species was abundant at Woodford Hill Bay, where they were found in 10 feet of water (pl. 1: fig. 2). Here a few fragments of weed were held over each test. In some places the echinoids occurred in such abundance that their tests were literally touching each other. Lewis (1958, p. 614) reports that in the Barbados individuals of this species crowd together on the upper surface of rocks during March and April in order to spawn. Presumably, since it was April when I saw this concentration in Dominica, these individuals also were spawning.

Echinometra lucunter (Linnaeus)

This species was found only at a few sites on the Caribbean side, usually restricted to intertidal zones. It was found only where the normal steep gradient of the sea floor was interrupted by a rock outcrop that formed a platform at intertidal depths. Such sites occur at Massacre, Crabiere Point, and Point Ronde. Here the echinoid occurs in great abundance with approximately two to four specimens in every square foot. Normally, the echinoid lives in a hollow that he presumably has formed in the rock. He is associated with many sea anemones and much algae. Many of the echinoids are exposed at low tide to the air. Deeper than eight feet they are rare, with their greatest concentration at one to two feet below low tide. In

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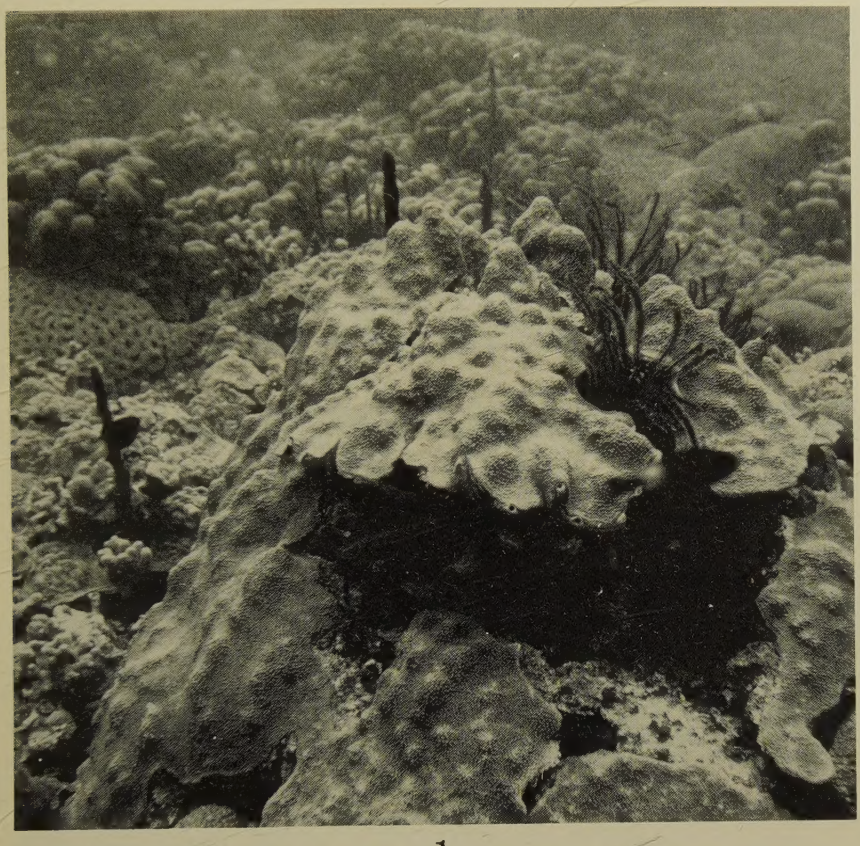
FIGURE 1.—Coral mass in 50-foot depth at locality 8; the crinoid *Comactinia echinoptera* (Muller) can be seen living in crevices in the coral. FIGURE 2.—*Tripneustes ventricosus* (Lamarck) in 10 feet of water in dense aggregations, presumably to spawn.



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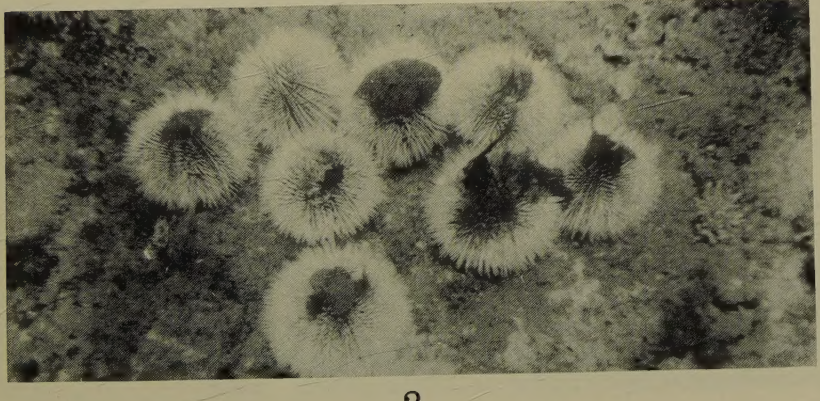

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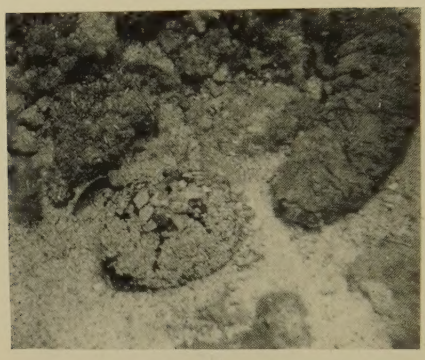

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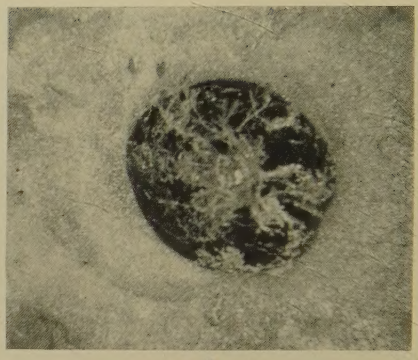

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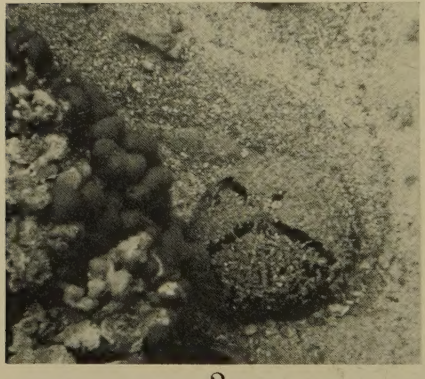

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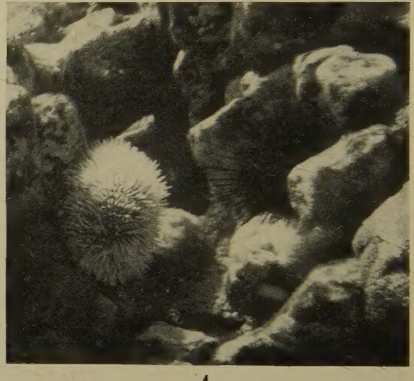

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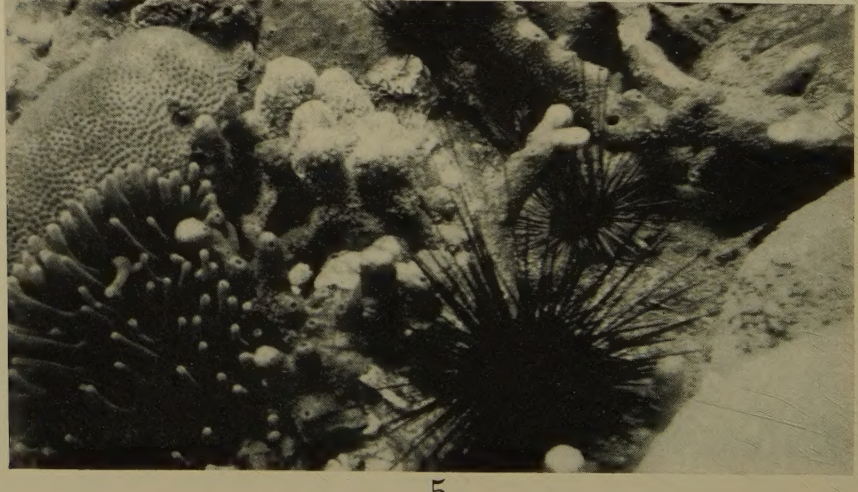

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every case they were living in areas of high energy with considerable wave motion. Two color types were present, the most common being dark brown but some specimens were much redder. Color difference is distinct, with no transition between the two types. Many individuals of *Diadema antillarum* Philippi and a few of *Eucidaris tribuloides* (Lamarck) and *Tripneustes ventricosus* (Lamarck) live with this species.

Echinometra viridis Agassiz

Only one specimen was seen and this one was found living in a niche in the coral at a depth of 50 feet. A long search was made for more specimens but none was found.

Diadema antillarum Philippi

PLATE 2 (FIGS. 4, 5)

This species is the most abundant of the echinoids living on the Caribbean side of the island. It occurs most commonly on the rocky-coral areas and is usually absent in the sandy bays. It was found in great numbers from low tide level to 65 feet and presumably lives even deeper. Most specimens live in hollows in the coral or rock, but some individuals were seen on the sandy patches within the rocky-coral areas. Although no individuals were ever seen under attack by fish, many disassociated spines were seen, indicating that successful attacks had been made. Both small fish and shrimp were frequently seen living among the spines.

Clypeaster subdepressus (Gray)

Although many dead tests of this species were seen, only one living individual was found. The species lives buried three or four inches in the sandy patches in the rocky-coral areas in association with *Meoma ventricosa* (Lamarck). It was most common in depths of 10 to 25 feet. The living specimen was found in 50 feet of water completely buried. Its location was indicated by the presence of whiter sand (which is usually underneath) on top of the specimen.

FIGURE 1.—*Meoma ventricosa* (Lamarck) with fragments of coral and shell pulled up over the test in 35-foot depth at locality 2; note coarser fragments over madreporite. FIGURE 2.—*Meoma ventricosa* (Lamarck) in 85-foot depth at locality 4; test covered only by bits of algae instead of the usual thick covering of shell fragments and pieces of coral; this is the greatest depth reached during the study and perhaps the echinoid is not covered very much because of the decreased amount of light at this depth. FIGURE 3.—*Meoma ventricosa* (Lamarck) in 35-foot depth at locality 6, showing lack of detrital material over petals and trail made by the echinoid. FIGURE 4.—*Tripneustes ventricosus* (Lamarck) clinging to rock in 2 feet of water at locality 8; *Diadema antillarum* Philippi can be seen to the right. FIGURE 5.—*Diadema antillarum* Philippi in 5 feet of water at locality 13.

Clypeaster rosaceus (Linnaeus)

Three dead tests were found at a depth of 25 feet in one of the sandy patches in the rocky-coral areas in association with *Clypeaster subdepressus* and *Meoma ventricosa* (Lamarck).

Leodia sexiesperforata (Leske)

This species was found living on the sandy areas in the bays in depths from 5 to 20 feet. The animal lives completely buried under 2 to 4 inches of silty sand. The echinoid makes no track in the sand visible on the upper surface of the sea bottom. In most cases the ripple marks on the bottom continue uninterrupted directly over the spot where the echinoid is buried. The only clue to the presence of living specimens is the occurrence of dead tests at the surface. In most places it occurs with no vegetation although in some areas a small amount of eelgrass is present.

Meoma ventricosa (Lamarck)

PLATE 2 (FIGS. 1–3)

Although not abundant, this species was found in sandy patches in every coral-rock environment from depths of 15 to 85 feet. Presumably it occurs at greater depth off Dominica but no dives were made below 85 feet. In other areas in the West Indies it has been dredged from depths down to 600 feet. It is not conspicuous on the bottom because it covers itself with sand and fragments of coral or weed. It would not be correct to say that it buries itself in the sediment, for only approximately one-fifth of its test is below the general level of the surrounding substratum. Rather than pushing itself under the sediment, the animal pulls the sediment over itself with its spines and tubefeet. Generally, larger fragments of coral are concentrated around the apical system (pl. 2: fig. 1). Presumably, the echinoid avoids placing small objects in the area of his madreporite. Although usually covered with sediment, the echinoid can be found because of the sorting of this sediment over the test, the large mound it makes on the bottom, and the lighter color of the sediment on the test. Furthermore, the echinoids leave a conspicuous track (pl. 2: fig. 3), usually two to three feet long, consisting of a furrow with a small ridge of sand on each side.

The echinoids do not occur in great density. On the average, four to six specimens occur in an area of 100 square ft. These sandy patches are usually 1–300 square feet in area and occur quite commonly in the coral-rock areas. Although similar sediment occurs in the noncoral tracts, this echinoid was never found there. At every station except one no weed or large algae was living in the sandy patches with the echinoids. The one exception occurred at a locality

85 feet deep (pl. 2: fig. 2), in which a small amount of algae was present. It may be of significance that, in this deepest area studied, the echinoids were almost completely naked with only a small amount of algae over their tests and no sediment. Perhaps it is because of the decreased amount of light at these depths that the test is not as completely covered.

Schizaster (Paraster) floridiensis Kier and Grant

One dead test was found at a depth of 85 feet on silt bottom devoid of vegetation off Point Guignard. Although no living specimens were found, the great fragility of the paper-thin test suggests that it could not have been carried far from where it once lived. Presumably, this species lives buried as is the case with all schizasterids with known living habits.

Comparison with Echinoids of the Florida Keys

It is of interest to compare the living habits of the Dominican echinoids with individuals of the same species in the Florida Keys, as recently described by Kier and Grant (1965). The echinoid fauna of Dominica was much less varied with only 10 species found, only 5 of which occurred in large numbers, whereas, in the Keys, 17 species were reported, most of which were common. Probably this difference is caused by the small number of different environments in the Caribbean off Dominica.

Meoma ventricosa was never found as deeply buried in Dominica as in the Florida Keys. The Dominican specimens only partially bury with approximately one-fifth of their tests below the general level of the substratum, whereas in the Keys most of the individuals keep their tests almost completely buried, many with an inch or so of sand over the upper surface. In Dominica, *M. ventricosa* lives very much like *Clypeaster rosaceus* does in the Keys, with sand and/or plant material pulled up over its test.

Leodia sexiesperforata lives deeper in the sand in Dominica than in the Keys perhaps because it occurs in shallower water there. In contrast, *Clypaester subdepressus* lives much deeper in Dominica, where it is found three to four inches below the surface, but in the Keys it normally walks along the surface with sand pulled over it or is buried under only an inch of sand. Because of this, they are very difficult to find in Dominica but easy in the Keys.

Diadema antillarum, *Echinometra lucunter*, *Echinometra viridis*, *Tripneustes ventricosus*, and *Eucidaris tribuloides* live in similar habitats in Dominica and the Florida Keys. It is of interest that the two color types of *Echinometra lucunter* found in Dominica are also present in the Keys.

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